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ABSTRACT

A study examined the change in the critical thinking skills of associate degree nursing students as they progressed through their educational process at the Reedsburg campus of Madison Area Technical College (MATC) in Wisconsin. The study sample consisted of two cohorts of 24 students each (students entering MATC's associate degree nursing program in August 1995 and August 1996 and graduating in May 1997 and 1998, respectively). Each cohort was selected through a randomized selection process from the first-day applicants who fulfilled all the program's prerequisites for entry. The students' critical thinking skills were examined by having them complete the California Critical Thinking Skills Test (CCTST) before starting and after completing their program of study. The study confirmed CCTST pre- and posttesting to be a viable means of assessing changes in students' critical thinking skills. One cohort exhibited a significant increase in critical thinking. Both cohorts manifested significant gains in their evaluation and inductive reasoning skills; however, neither cohort demonstrated significant gains in their analysis, inference, and deductive thinking skills. (The report contains 45 references and 17 tables/figures. Appended are a discussion of validation of the California Critical Thinking Skills Test and the agreement to participate as a research subject.) (MN)

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ED 430 081

ASSESSMENT OF CRITICAL THINKING SKILLS IN ASSOCIATE DEGREE NURSING STUDENTS

at Madison Area Technical College - Reedsburg

by

Frances Soukup

A Research Paper

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Education Specialist
With a Major in

Professional Education

The Graduate College
University of Wisconsin - Stout
May, 1999

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ABSTRACT

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Critical thinking is a major component of nursing education. Programs in nursing must assess critical thinking as a required outcome for national accreditation by the National League for Nursing. In March, 1996, Madison Area Technical College Associate Degree Nursing faculty identified critical thinking as a major content thread to be carried as a priority for instruction through all four semesters of the Associate Degree Nursing program.

The purpose of this study was to determine the degree of change in critical thinking skills in Associate Degree Nursing students as they progress through their educational process at Madison Area Technical College. Cohorts of twenty-four students, entering the Associate Degree Nursing program at Madison Area Technical College - Reedsburg campus, in August, 1995 and August, 1996 and graduating in May, 1997 and May, 1998, comprised the samples. The California Critical Thinking Skills Test - Form A (CCTST) was administered to the entering Associate Degree Nursing class

in August of 1995 and in August of 1996 - prior to the beginning of program instruction. The California Critical Thinking Skills Test Form A was also administered at the completion of the program of study (May, 1997 and May, 1998). The California Critical Thinking Skills Test - Form A was administered by the researcher at the Madison Area Technical College - Reedsburg campus.

To assess the degree of change in thinking skills, the pre-test CCTST scores were compared to the post-test CCTST scores. The comparison was made by subtracting the pre-test score from the post-test score for each individual. The resulting change scores were analyzed with the t-test of differences.

The major outcome of this study was to identify CCTST pre- and post-testing of MATC's ADN students as a viable means of assessing their change in critical thinking skills. One group showed a significant increase in the total score for the CCTST, based on positive gains in their scores for the five sub-tests that impacted the total score. Further outcomes were to identify a significant change in both evaluation and inductive reasoning thinking skills in the two groups of students: One group showed a significant increase in evaluation thinking skills; the other group had a positive gain in evaluation thinking skills, although it was not statistically significant. One group showed a significant increase in the critical thinking skill subset Inductive Reasoning. An additional benefit of the study was to identify limited, if any, change in analysis, inference, and deductive thinking skills in the program students. These areas of limited change then become areas to be further evaluated by the ADN program.

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Chapter I

Research Problem and Objectives

Introduction

Critical thinking is a major component of nursing education. The practice of professional nursing necessitates the application of critical thinking skills to problem solve, develop ideas, and provide quality health care. In nursing and other health care professions, life or death may depend on the problem-solving done in an emergency situation or upon the interpretations of subtle changes in a recovering patient's status. Critical thinking is an essential skill (Facione, Facione, & Giancario, 1998). In 1997, the National League for Nursing, the educational accreditation agency for nursing, identified critical thinking as one of four performance indicators for national accreditation. These performance indicators are to be assessed to provide evidence to demonstrate the purposes of the educational program and the program effectiveness. Therefore, programs in nursing must assess critical thinking as a required outcome for national accreditation (National League for Nursing, 5/29/98).

Madison Area Technical College has a two year Associate Degree Nursing program, offered at four of its campuses: Truax, Reedsburg, Watertown, and Fort Atkinson. The program curriculum is the same throughout the district. On March 1, 1996, nursing faculty identified critical thinking as a major content thread to be carried as a priority for instruction through all four semesters of the Associate Degree Nursing program (ADN Minutes).

Research Problem

The purpose of this study is to determine the degree of change in critical thinking skills in Associate Degree Nursing students as they progress through their educational process at Madison Area Technical College.

Cohorts of twenty-four students, entering the Associate Degree Nursing program at Madison Area Technical College - Reedsburg campus, in August, 1995 and August, 1996 and graduating in May, 1997 and May, 1998, comprised the sample. The California Critical Thinking Skills Test - Form A was administered to the entering Associate Degree Nursing class in August of 1995 and in August of 1996 - prior to the beginning of program instruction. The California Critical Thinking Skills Test Form A was also administered at the completion of the program of study (May, 1997 and May, 1998). The California Critical Thinking Skills Test - Form A was administered by the researcher at the Madison Area Technical College - Reedsburg campus.

Research Hypotheses

The following hypotheses were tested:

1. There will be an increase in the critical thinking skills of Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.
2. There will be an increase in the critical thinking skill subset "Analysis" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.

3. There will be an increase in the critical thinking skill subset "Evaluation" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College-Reedsburg.

4. There will be an increase in the critical thinking skill subset "Inference" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.

5. There will be an increase in the critical thinking skill subset "Deductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg.

6. There will be an increase in the critical thinking skill subset "Inductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg.

Research Objectives

The objectives of this study were:

1. To determine the degree of change in critical thinking skills in Associate Degree Nursing students at Madison Area Technical College - Reedsburg.

2. To assess the feasibility of using the California Critical Thinking Skills Test Form A to develop performance standards related to critical thinking

for the Madison Area Technical College Associate Degree Nursing program.

Need for the Study

All levels of nurses are expected to embrace and practice critical thinking in their professional roles. Although Madison Area Technical College faculty have incorporated critical thinking as a thread through all four semesters of the program and in each nursing course, performance standards for critical thinking have not been identified for the program. A consistent assessment plan for critical thinking skills in the Associate Degree Nursing students needs to be delineated for successful continuance of the Madison Area Technical College Associate Degree Nursing program in order to maintain its accreditation status and to provide quality graduate nurses. An assessment methodology for critical thinking needs to be set in place.

Limitations

The scope of this study is limited to two cohorts of Associate Degree Nursing students, at the Madison Area Technical College - Reedsburg campus, entering August, 1995 and graduating in May, 1997, and entering August, 1996 and graduating in May, 1998. Only students who were enrolled with the program for two consecutive years were included in the study. Students admitted with advanced standing or transferring into the program from another technical college district or MATC campus were not included in the study.

Assumptions

It is assumed that the Associate Degree Nursing students at the Madison Area

Technical College - Reedsburg campus are representative of the population for the entire Madison Area Technical College Associate Degree Nursing program, located at Madison, Watertown, Fort Atkinson, and Reedsburg. Madison Area Technical College - Reedsburg Associate Degree Nursing graduates consistently comprise 23% (averaging 22 graduates out of approximately 95 graduates) of the total number of Associate Degree Nursing program graduates. Associate Degree Nursing students enrolled at the Madison Area Technical College - Reedsburg campus have the same entrance requirements and pre-requisites for admission to the program as students at other campuses. Graduates of the Madison Area Technical College - Reedsburg Associate Degree Program have the same pass rate on the registered nurse licensure exam as those Associate Degree Nursing graduates from other Madison Area Technical College campuses (averaging 95% over ten years).

Definition of Terms

In 1990, a consensus definition of critical thinking skills emerged as a Delphi study commissioned by the American Philosophical Association to clarify the conceptualization of critical thinking. These consensus definitions are described in Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction, The Delphi Report, (Facione, 1990):

Analysis: To identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions, which includes the sub-skills of examining ideas, detecting arguments, and analyzing arguments into their

component elements. (p. 8)

Critical Thinking: Purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based. (p. 2)

Deductive Reasoning: The assumed truth of the premises purportedly necessitates the truth of conclusion. Traditional syllogisms, algebraic, geometric, and set-theoretical proofs in mathematics are examples of deductive reasoning. (p. 5)

Evaluation: To assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion, which includes the sub-skills of assessing claims and assessing arguments. Evaluation also means to state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments, which includes the sub-skills of stating results, justifying procedures, and presenting arguments. (p. 9)

Explanation: To state the results of one's reasoning; to justify one's reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments, which includes the sub-skills of stating results, justifying procedures, and presenting arguments. (p. 11)

Inference: To identify and secure elements needed to draw reasonable conclusions: to

form conjecture and hypotheses, to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation, which includes the sub-skills of querying evidence, conjecturing alternatives, and drawing conclusions. (p. 10)

Interpretation: To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, procedures or criteria. (p. 7)

Inductive Reasoning: An argument's conclusion is purportedly warranted, but not necessitated, by the assumed truth of its premises. Scientific confirmation and experimental confirmation are examples of inductive reasoning. (p. 5)

Self-Regulation: Self-consciously to monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results, which includes the sub-skills of self-examination and self-correction. (p. 12)

Chapter II

Review of Related Literature

Introduction

The literature review was conducted through ERIC and electronic search banks and library holdings at Madison Area Technical College, the University of Wisconsin - Stout, the University of Wisconsin - Madison, the Wisconsin Technical College System, and through Internet search banks. For the purpose of this study, the literature review was focused upon critical thinking, assessment of critical thinking, critical thinking in nursing, assessment of critical thinking in nursing, and critical thinking at Madison Area Technical College and its Associate Degree Nursing program.

Critical Thinking

The concern of philosophers with critical thinking dates back to ancient times, when Plato and Aristotle were interested in formal logic systems. Early Hindu writings showed some parallel development in the analysis of concepts (Miller & Connelly, 1996).

For the better part of the twentieth century, **schooling** has concerned itself with developing techniques, skills, and factual knowledge, while **training** has concerned itself with supplying scripted solutions to predetermined solutions to predetermined problems. However, **education** as practiced in the better liberal arts based professional programs, is structured to include the goal of teaching people to think (Facione, Facione, & Giancario, 1998).

In this century, John Dewey is recognized as the modern-day founder of the critical thinking movement (Ennis, 1993). Dewey in How We Think stated:

> ...thinking enables us to direct our activities with foresight and to plan according to ends-in-view, or purposes of which we are aware. It enables us to act in deliberate and intentional fashion to attain future objects or to come into command of what is now distant and lacking. By putting the consequences of different ways and lines of action before the mind, it enables us to know what we are about when we act. It converts action that is merely appetitive, blind, and impulsive into intelligent action. (1910, p. 17)

In 1941, Edward Glaser defined critical thinking as dependent both on one's notion of what it means to think critically and on one's view of the reasons for critical thought. He stated that critical thinking involved three principal elements, "Attitude of being disposed to consider in a thoughtful, perceptive manner the problems and subjects that come within the range of one's experience, knowledge of the methods of logical inquiry and reasoning, and, skill in applying these methods" (p. 5). Glaser concluded his discussion by arguing that critical thinking is more than a desirable educational objective, it also "helps the individual cooperate with others" (p. 6). In 1961, the Educational Policies Commission continued to identify critical thinking as a goal of education in The Central Purpose of American Education (Ennis, 1993).

Sternberg (1986) considered the study of critical thinking to be of particular interest because of its joining and melding of three traditions of thought - the educational, the psychological, and the philosophical. The educational tradition of

critical thinking draws heavily upon classroom observation, text analysis, and process analysis of thinking in the classroom to guide thinking about critical thinking. Bloom's taxonomy of cognitive skills, dating from 1956, and Gagne's hierarchy of learning skills, dating from 1965, have drawn heavily upon classroom observation (Sternberg, 1986).

The psychological tradition was concerned with characterizing critical thinking as it was performed under the limitations of the person and the environment. In other words, the study of critical thinking was valuable in showing how people thought critically in the absence of full information, unlimited time, perfect memory, and so forth. The psychologists (Bransford, 1984; Bruner, 1960; Feuerstein, 1980; & Sternberg, 1985) often tested their subjects in laboratory settings, using subjects with select limitations in thinking capability (Sternberg, 1986).

The philosophical tradition focused less upon the requirements of critical thinking in the classroom than upon the requirements of formal logical systems. The rules of logic can tell us how people might think critically under ideal circumstances in which the limitations typically placed upon the human information processing system are not in place. However, there are numerous potential limitations that ordinarily block the utilization of our full competence - limited time, limited information, limited working memory capacity, limited motivation, and so on. Philosophical traditionalists in critical thinking were more interested in examining models of competence rather than models of performance. Robert Ennis and Richard Paul have been identified as leaders of the philosophical group of critical thinking theorists (Sternberg, 1986).

Ennis (1985) defined critical thinking as "reflective and reasonable thinking that

is focused on deciding what to believe or do" (p. 45). He considered critical thinking to be a much clearer concept than "higher order thinking skills" (p. 45). Ennis also considered higher order thinking skills to be so vague a term that it was useless as a guide for the development of teaching, curriculums, and evaluation procedures. It did, however, have one persuasive function, according to Ennis - to remind educators that there is much more to be learned in school than elementary reading, writing, arithmetic, and banks of memorized and soon-to-be-forgotten facts (Ennis, 1985).

Ennis also considered a further conceptualization of critical thinking as higher-order thinking skills. Ennis compared the three top levels of Bloom's taxonomy (analysis, synthesis, and evaluation), and the next two lower levels (comprehension and application), as higher order thinking skills. However, he expressed concern over the vagueness of the terms and the lack of criteria for judging outcome of activities to be of value in considering the characteristics and abilities of critical thinkers (Ennis, 1985).

The need for a clear understanding of the critical thinking construct led a committee of the American Philosophical Association to undertake a project in 1987 to achieve a consensus definition of critical thinking (Facione, 1990). The completed "Delphi" research project was published in 1990, representing a consensus definition of critical thinking achieved from the anonymous and iterative survey of 46 published critical thinking theorists in a variety of disciplines. The following consensus statement regarding critical thinking (CT) and the ideal critical thinker is a result of the project:

> We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as

> explanation of the evidential, conceptual, methodological, criteriological, or essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational democratic society. (APA, 1990, p. 3)

In 1989, the building momentum to list critical thinking as a core educational outcome provoked the National Governors' Association, then headed by Governor Bill Clinton of Arkansas, to incorporate critical thinking among its recommendations for national educational goals. In 1990, in response to the Governors' report, and aware of the growing enthusiasm for educational reform, President George Bush, in his state of the union address, urged the federal government to adopt National Goals 2000.

In 1991, the National Center for Education Statistics sponsored a workshop on Assessing Higher Order Thinking & Communication Skills in College graduates. The

focus of this workshop was to develop a process to develop the goals and the objectives for higher education contained in National Education 2000. National Education Goal 5 directly addressed critical thinking: The goal: "By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship" (Nummedal, 1991, p. 2); and, the objective: "The proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively and solve problems will increase substantially" (Nummedal, 1991, p. 2).

In 1990, NCRIPTAL (the National Center for Research to Improve Postsecondary Teaching and Learning) research into over two thousand faculty members' goals revealed a wide range of educational aims. The goals reported by introductory course instructors from twelve different college-level fields and disciplines ranged from having the student acquire specific knowledge from the academic field to helping students acquire critical and independent thinking skills. Instructors whose goals were to help students grow intellectually often spoke about broadening the students' intellectual vistas, teaching them to organize and clarify their thinking, helping them develop critical-thinking skills, teaching them how to analyze problems and follow logical approaches to situations, and encouraging them to discover and express their own thoughts. The task of fostering self personal growth in students as expressed in faculty goals, involves helping students realize that there is seldom just one answer or one way of solving a problem, that no one person can have all the answers, that thinking is fun and challenging, that there are rarely simple answers, and that learning is a life-long process (Cameron, 1990).

> In a research paper discussing critical thinking skills, Jan Corder states:
>
> Critical thinking skills do not happen automatically. Neither can teachers teach students to think critically simply by wanting them to do so. Specific attention must be paid to the development of these skills and specific deliberate teaching strategies must be employed by the teacher. One cannot coerce a learner to think critically or force another to analyze critically the values, beliefs, and assumptions on which their lives are built. (Corder, 1992, p. 5)

With the Clinton administration, plans for a national proficiency examination shifted to an individual focus where State legislatures are charged with determining how their individual State will respond to this mandate. The emphasis has now shifted to two specific foci: "How can critical thinking best be taught in our classrooms/clinical settings/field settings?" and, "How can we best demonstrate students' critical thinking in a student assessment project for the purposes of curriculum or program evaluation?" (Facione, N., 1995).

In 1993, the US Department of Education mandated the demonstration of a significant improvement in critical thinking in all our nation's college graduates by the year 2000 (National Goals 2000). No specific guidelines for what level of student was to be considered a "college graduate," what constituted "significant improvement," or how that improvement might be demonstrated were identified (Facione, 1995).

The consensus definition of critical thinking (CT), as defined in the American Philosophical Association Delphi report, was confirmed in 1994 by 200 policy-makers, employers, and faculty members from two-year and four-year colleges, government

agencies, and small and large businesses in a replication study commissioned by the US Department of Education Office of Educational Research and Instruction. This replication study was carried out from 1993 through 1994 at Pennsylvania State University's National Center on Post-Secondary Teaching, Learning and Assessment. The expert consensus definition was strongly endorsed in terms of its descriptions of both the skills and disposition of critical thinkers (Jones and Radcliff, 1994).

The emphasis for continued lifelong learning of critical thinking skills continues. On May 28, 1998, the National Education Goals 2000 were updated. The National Education Goal 6: Adult Literacy and Lifelong Learning states: "By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the right and responsibilities of citizenship" (National Education, 7/3/98, p. 1). One of the objectives for National Education Goal 6 most clearly addressed critical thinking: "The proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively, and solve problems will increase substantially" (National Education, 7/3/98, p. 1).

Assessment of Critical Thinking

The critical thinking assessment movement can be traced back to Edward Glaser's An Experiment in the Development of Critical Thinking (1940). In 1941, Glaser and Watson developed the Watson-Glaser Critical Thinking Test (Paul, 1984).

Paul (1984) stated, "Unlike the case of computer skills or other technical skills, there is a natural disinclination for people to recognize the degree to which they themselves have not developed critical thinking skill"(p. 6). He goes on to state:

> Most people, including the most uncritical, take offense at the suggestion that they lack skill in this area. This ego-identification with critical thinking (it is the **others** who need it) is a continual problem in the nurturing of such skills. To the extent that people lack critical thinking skills, they conceptualize those who have them as prejudiced, close-minded, overly academic, negative or nit-picky . . . It is well to emphasize that the ability to think critically is a matter of **degree**. No one is without **any** critical skills. (p. 7)

In The Delphi Report, Peter Facione (1990) lists four recommendations which address the assessment of critical thinking (CT).

> Recommendation 8: Direct instruction in CT and assessment of CT should be an explicit parts of any course granted approval for purposes of satisfying CT requirements, whether that course is a CT course **per se** or a course in a given subject field. The primary academic criterion in the evaluation of a proposed instructional program for purposes of achieving the CT goal should be whether the program will further the development of students' CT skills and dispositions. (p. 16 - 17) Recommendation 11: . . . Minimum CT proficiency expectations should be set for each additional education level, including promotion in grade, high school graduation, college, entrance, and graduate school admission. (p. 18) Recommendation 12: In evaluating the acceptability of a CT assessment strategy or instrument one should consider content validity, construct validity, reliability, and fairness. (p. 19) Recommendation 13: CT assessment should occur frequently, and it should be used diagnostically as well as summatively. Different

> kinds of instruments should be employed, depending on which aspect of CT is being targeted and where students are in their learning -- the introductory stage, the practice stage, the integration stage, or the generalized transfer stage. (p. 20)

Paul (1991), at a workshop on Assessing Higher Order Thinking & Communication Skills in College Graduates, reviewed the status of critical thinking research. Critical thinking research has emphasized three basic needs for all learning: For all students to **reason out** all basic concepts and understandings, to **reason to** all basic conclusions and solutions, and to **reason through and across** the curriculum. This emphasis has been embedded in the structure of the 11 major international conferences on research into critical thinking and educational reform (1980 - 1991) held at Sonoma State University, attracting 1400 registrants from 20 countries and involving over 350 sessions representative of a wide variety of academic disciplines. This same emphasis is reflected in the 25 or so other conferences focused on critical thinking in the last ten years (at Harvard, the University of Chicago, Montclair State, Oakton College, and elsewhere) and in most of the articles published concerning critical thinking. He goes on to state, "The research into critical thinking has focused not only on the cultivation of reasoning in all disciplines but also on generalizable standards for the assessment of reasoning as well" (Paul & Nosich, 1991, p. 2).

Susan Nummedal (1991), at a workshop on Assessing Higher Order Thinking & Communication Skills in College Graduates, stated:

> We simply must have baseline data for the skills and dispositions we choose to assess. We need to know where the students start with respect to these specific

skills and dispositions in order to make sense out of the data describing where they end up. Ideally, the assessment should have a longitudinal design with the same individuals measured over the course of college years. Given the difficulties associated with such a design, there should be at least be a cohort design to provide a picture of the entry level higher order thinking skills and the changes that occur over the college years. (p. 14)

Paul (1991) identified limitations in all twelve of the commercially available critical thinking tests as instruments for assessing higher order thinking:

Cornell Class Reasoning Test, Form X (1964)

Cornell Conditional Reasoning Test Form X (1964)

Cornell Critical Thinking Test, Level X (1985)

Cornell Critical Thinking Test, Level Y (1985)

The Ennis-Weir Critical Thinking Essay Test (1985)

Judgement: Deductive Logic and Assumption Recognition (1971)

Logical Reasoning (1955)

New Jersey Test of Reasoning Skills (1983)

Ross Test of Higher Cognitive Processes (1976)

Test on Appraising Observations (1983)

Watson-Glaser Critical Thinking-Appraisal (1980)

None of these tests were designed to serve as a national assessment tool which establishes national standards in higher order thinking and motivating and guiding instruction (Paul & Nosich, 1991).

Paul (1991) goes on to state, "The national assessment proposed would offer a range in interdisciplinary items, constructed by experts well versed in a rich and substantive concept of critical thinking. The minimal recommendation is that all portions of the assessment be given to a representative sample of the student population at each educational institution" (p. 26). The assessment proposed by Paul would include two broad areas of testing: a machine-gradable portion that includes multiple choice items and multiple-rating items and an essay portion. Paul proposed that the test should last about three hours, with a total of at least 30 items, two of these being short essay. He felt the instrument should be administered by a private agency whose personnel had critical thinking credentials increase with reliability (Paul & Nosich, 1991).

Ennis (1993) stated, "Since the early 1980's, attention to critical thinking instruction has increased significantly - with some spillover to critical thinking assessment, an area that has been neglected even more than critical thinking instruction" (p. 179). He goes on to state "Critical thinking assessment, albeit difficult to do well, is possible" (p. 179). Two subthemes are that the difficulties and possibilities vary with the purpose of the critical thinking assessment and the format used, and there are numerous traps for the unwary. The assessment information would enable institutions to target instruction to remediate weaknesses and to build on strengths, as well as to measure what students were gaining as a result of attending their classes.

Ennis (1993) listed seven purposes for critical thinking assessment:

1. Diagnosing the levels of students' critical thinking.
2. Giving students feedback about their critical thinking prowess.

3. Motivating students to be better at critical thinking.

4. Informing teachers about the success of their efforts to teach students to think critically.

5. Doing research about critical thinking instructional questions and issues.

6. Providing help in deciding whether a student should enter an educational program.

7. Providing information for holding schools accountable for the critical thinking prowess of their students. (p. 180 - 181)

Purposes 6 and 7 are frequently called "high stakes" testing, because so much often depends upon the results. Examples of "high stakes"tests, which include sections for measurement of critical thinking, are the American College Tests (ACT), Medical Colleges Admissions Test (MCAT), College Board Advanced Placement (AP) tests, Graduate Record Examination (GRE), and the Law School Aptitude Test (LSAT) (Ennis, 1993).

Ennis (1993) goes on to describe the traps educators need to be aware of as they pursue the above purposes of critical thinking assessment:

1. Tests results may be compared with norms, and the claim made that the difference, or similarity, is the result of instruction.

2. A pre-test and a post-test may be given without comparing the class to a control group.

3. The use of the same test for the pretest and the posttest has the problem of alerting the students to the test questions. On the other hand, the use of

3. Motivating students to be better at critical thinking.

4. Informing teachers about the success of their efforts to teach students to think critically.

5. Doing research about critical thinking instructional questions and issues.

6. Providing help in deciding whether a student should enter an educational program.

7. Providing information for holding schools accountable for the critical thinking prowess of their students. (p. 180 - 181)

Purposes 6 and 7 are frequently called "high stakes" testing, because so much often depends upon the results. Examples of "high stakes"tests, which include sections for measurement of critical thinking, are the American College Tests (ACT), Medical Colleges Admissions Test (MCAT), College Board Advanced Placement (AP) tests, Graduate Record Examination (GRE), and the Law School Aptitude Test (LSAT) (Ennis, 1993).

Ennis (1993) goes on to describe the traps educators need to be aware of as they pursue the above purposes of critical thinking assessment:

1. Tests results may be compared with norms, and the claim made that the difference, or similarity, is the result of instruction.

2. A pre-test and a post-test may be given without comparing the class to a control group.

3. The use of the same test for the pretest and the posttest has the problem of alerting the students to the test questions. On the other hand, the use of

different forms of (allegedly) the same test for critical thinking, is probably worse, since different forms are actually different tests. Comparability is always suspect, since so much depends on the specific content of the test.

4. Most critical thinking tests are not comprehensive, especially those that are easiest to use.

5. Multiple-choice tests do not adjust for differences in background beliefs and assumptions between test maker and test taker. Different beliefs about the situation can sometimes result in justifiably different answers to test questions.

6. Significant results may be expected in too short a time period. Learning to think critically takes a long time.

7. High-stakes purposes often interfere with the validity of a test.

8. Scarce resources often lead to compromises that affect test validity. (p. 181)

Although a number of tests incorporate critical thinking, only a few have critical thinking (or some aspect of critical thinking) as their primary concern. Several tests assess more than one aspect of critical thinking. These general-content-based tests use content from a variety of areas with which tests takers are presumed to be already familiar (Ennis, 1993).

In 1994, three instruments were widely recognized as appropriate assessment tools for the measurement of critical thinking in adults. These were listed in The Supplement to the Eleventh Mental Measurements Yearbook (Conoley & Impara, 1994). These assessment instruments were the Watson-Glaser Critical Thinking Appraisal, the Cornell Critical Thinking Tests, and the California Critical Thinking Skills Test.

The Watson-Glaser Critical Thinking Appraisal (WGCT) provides scoring in six areas: Inference, recognition of assumptions, deduction, interpretation, evaluation of arguments, and total critical thinking ability (Conoley & Impara, 1994). The WGCT, designed for testing with grades 9 - 12 and adult, was published from 1942 - 1985. The following is a review of the Watson-Glaser Critical Thinking Appraisal by Gerald C. Helmstadter, Professor of Educational Psychology, Arizona State University, Tempe, Arizona:

> The careful appraisal of critical thinking should be an extremely important endeavor in our society - one worthy of a great deal of careful research adequately backed by financial support. For as our world becomes increasingly complex and technical, the need for individuals with this capability will surely expand. Indeed, the development and identification of this characteristic could become the central focus of educational and employee selection. Given the possibility for its usefulness, it is quite surprising the authors and publishers have not developed this test to its fullest potential in the nearly 40 years since its inception. Nor do they seem to have made much of an improvement in the 16 years since the previous edition.
>
> In summary, if the user is in agreement with the authors' definition of critical thinking and the way in which the test items operationalize the construct, and further, if the user does not need to make precise statements about the level of performance of an individual examinee, this instrument is well worth trying. At the same time, this reviewer feel that an imaginative researcher who is willing to

> put forth the necessary effort could develop an alternative instrument which would both stimulate and capture the market for the measurement of this important characteristic of human endeavor. (Conoley and Impara, 1994, p. 1693 - 1694)

The Cornell Critical Thinking Tests stated purpose is to assess general critical thinking ability including "induction, deduction, evaluation, observation, credibility (statements made by others), assumption, identification, and meaning" (Conoley & Impara, 1994, p. 241). The Cornell Critical Thinking Tests , designed for Advanced and gifted high school students and college students and adults, were published from 1961 - 1985. The following is a review of the Cornell Critical Thinking Tests (CCTT) by Jan N. Hughes, Associate Professor of Educational Psychology, Texas A&M University, College Station, Texas:

> The content of the Cornell Critical Thinking Tests was selected based on Ennis's conceptualization of critical thinking skills. Level X is intended for use with elementary and junior high school students, and Level Z is intended for advanced and gifted high school students and adults and for college students. Both tests consist of multiple-choice items, and the 50 minutes allocated for test administration appears adequate for the 71 items on level Z and the 52 items on Level Z. Both levels employ a story format that is likely to maintain the test taker's interest.
>
> The CCTT has many positive aspects. The developers caution the reader against using subscale scores to make individual comparisons. This caveat is important

given the small number of items on some scales and the lack of evidence from factor analytic studies that the subscales measure distinct skills. The developers avoid describing the CCTT as a measure of intelligence or innate reasoning abilities and, indeed, emphasize on learned skills is laudable. The manual is clearly written at a level of sophistication appropriate for the most likely potential test users - educators. The developers exercise appropriate caution in their claims for the test's reliability and validity. They warn that if the test is used as a criterion for selecting students into graduate school, it should not be the sole criterion.

Despite these positive aspects, there are several weaknesses that limit the test's usefulness. It is disappointing these shortcomings have not been addressed with more vigor in the 14 years since the 1971 edition of the test.

The norms are described as user norms to emphasize that they are not representative of some well-described group. The norms do not permit the user to compare a student's or group's performance to a normative group. However, norms are not as important to the use of the CCTT as a teaching evaluation tool, the use of the authors recommend most highly. Because the developers suggest the best use of the test is in the evaluation of teaching and curriculum development, studies demonstrating the test's sensitivity to instruction would provide important validity data. Only a few studies have investigated the test's sensitivity to instruction. These studies are not well conceptualized and the results do not lead to any definitive conclusions as to the test's construct validity.

> In summary the evidence that the CCTT measures some ability different from existing measures of intelligence and achievement to predict success in endeavors presumably calling for critical thinking skills would help to assess the construct validity of the CCTT. (Conoley & Impara, 1994, p. 241 - 244) ·

The third instrument in wide use, the California Critical Thinking Skills Test, was designed to be "a standardized assessment instrument targeting core critical thinking skills at the post-secondary level" (Coloney & Impara, 1994, p. 37). The California Critical Thinking Skills Test is based upon the American Philosophical Association's Delphi consensus conceptualization of critical thinking. The California Critical Thinking Skills Test, designed for college students and adults, has publication dates from 1990 - 1992. The following is a review of the California Critical Thinking skills Test by Robert F. McMorris, Professor of Educational Psychology and Statistics, State University of New York at Albany, Albany, New York:

> In Roget's Thesaurus (Chapman, 1992, p. 842), a synonym given for "critical" is "crucial." Certainly critical thinking skills are crucial for individuals and society, and developing an appropriate test to assess critical thinking skills is no trivial task. The California Critical Thinking Skills Test (CCTST) contains 34 multiple-choice items with a 45 minute time limit. The items cover a variety of topics: Some items are realistic, providing high face validity, but they potentially confound reasoning with content; and some are "nonsense," content-free items for those who prefer a more abstract approach. The items seem reasonably interesting.

A Delphi panel developed a consensus definition of critical thinking (CT), core CT skills with examples, and dispositions crucial to becoming a critical thinker. The test contains three subscores based on the panel's work: Analysis, Evaluation, and Inference. The developer, Facione, also apologetically offers two other subscores, Deductive Reasoning and Inductive Reasoning, based on 30 of the 34 items, to meet a California State University objective. (Given the double use of most items, we will refer to subscores rather than subtests.)

The developer conducted several studies using the CCTST at California State in Fullerton involving 1,196 undergraduates, 20 instructors, 5 different courses, and three academic departments. These data are bases for validity, reliability, and norm information. (Coloney & Impara, 1994, p. 37 - 39)

William B. Michael, Professor of Education and Psychology, University of Southern California, Los Angeles, California, adds the following:

The CCTST would appear to possess substantial content validity - perhaps more than any other competing instrument in light of the collective wisdom of the eminent scholars who contributed to its development. The resulting score distributions, which are normal in form, provide a basis for differentiating quite adequately among the examinees. The 34 items are not easy. On the pretest the highest score for the sample of students studied was 29, and on the posttest 31 with a respective means of 15.89 ad 17.27. There may be some concern relative to the 45-minute time limit (Conoley & Impara, 1994, p. 39 - 40).

Peter Facione (1998), author of the California Critical Thinking Skills Test

(CCTST), describes the CCTST in the following terms:

> The CCTST presents 34 multiple-choice test items. Each item requires the test taker to form a judgment about the best response, from among those provided, to a question involving a more or less every day situation or problem. No specialized knowledge is required, other than what can reasonably be expected of a person who has received a modest high school education AND can read at a tenth grade level. No technical vocabulary is used. To consistently answer correctly, the person must be skilled at inductive and deductive reasoning and at making correct analyses, inferences, and evaluations. The CCTST is a very challenging test of CT, but not a test about CT. (Facione, P., 1998, p. 6 - 7)

Critical Thinking in Nursing

Almost 40 years ago, nursing leaders developed a strategy to establish a separate identity from and professional parity with medicine. They acknowledged the power of the methods and values of the dominant culture of medicine by adapting its practices. The nursing process emerged from the scientific method, which had long been accepted as the only legitimate means of problem solving in medicine. Nursing process became the only legitimate means of problem solving in nursing. The nursing process uses assessment, diagnosis, intervention, and evaluation. The goal is to systematically and objectively apply rules to arrive at the correct solution to the patient's identified problem. Today, virtually every nursing practice textbook is modeled on the nursing process. Most nursing curricula identify the nursing process as an essential component, many state boards of nursing identify the nursing process as a necessary element in educational

program approval, and the National Council Licensure Examination for Registered Nurses is based on the nursing process (Jones and Brown, 1993).

It is critical nurses make effective clinical decisions about patient problems. Clinical decision-making or judgment is a highly desirable skill that most educators talk about and that many managers complain is nonexistent, but neither is absolutely sure how to teach or evaluate. The decision-making process can be logical or illogical, deductive or inductive, can be partially taught, and to some degree can be measured quantitatively and qualitatively. Certain aspects of nurses' clinical decision-making can be learned and evaluated by examination of decision outcomes and analysis of the rationale given for the choice of action or the process by which the decision came about. However, numerous factors such as risk, urgency, possible consequences, previous experience, available data base, values, and anxiety complicate conclusions drawn from any single example of a nurse's clinical judgment (del Bueno, 1983).

As members of a profession in which situations change rapidly, nurses cannot depend upon routinized behavior, procedure manuals, or traditions to guide clinical judgment and decision-making. They must develop the ability to make guided decisions drawn from sound, rational bases in order to respond appropriately under the stress of fast-paced clinical environments. The development of critical thinking is an indispensable component of education for clinical nursing practice. (Malek, 1986).

In 1989, the National League for Nursing (NLN), the accrediting body for nursing education, took a fore-runner position on critical thinking by requiring the demonstration of critical thinking in graduates of nursing education programs. "The curriculum

emphasizes the development of critical thinking as a specific criterion for accreditation" (National League for Nursing, 1989, p. 34). In so doing the NLN positioned nursing to lead other professional preparation programs to explore critical thinking criteria for learning outcomes, particularly military science, pharmacy, and business (Facione, N., 1995).

Miller and Malcolm (1990) expressed the concern of faculty. With the increasing emphasis on critical thinking in the nursing curriculum, there is concern that it will become another unit of content competing with other units that must be included somewhere in the curriculum. Critical thinking is much more than this. It is a combination of an attitude of inquiry, supported by a knowledge base and enhanced by skill in application. Critical thinking is an approach to inquiry where both students and faculty examine clinical and professional issues and search for more effective answers (Miller & Malcolm, 1990).

In 1991, a survey of deans and directors of baccalaureate and higher-degree schools of nursing accredited by the National League for Nursing examined perceptions of critical thinking as it was then characterized in nursing education. Results indicated that critical thinking was conceptualized as a variant of the scientific method. Jones (1991) stated, " . . . the predominant model in baccalaureate education in the United States is predicated on critical thinking as a problem-solving activity using principles of objectivity, prediction, and control. Critical thinking was usually operationalized as a rational-linear process; as a function of deductive logical thinking" (p. 532). Jones went on to state:

> Decision-making in clinical nursing practice, in reality, is more often composed of contextually defined value judgments. The problems of everyday nursing practice are rarely settled in a rational, linear manner. More often, nursing practice is governed by negotiation between alternative points of view, contradictory lines of reasoning, and the realities of situational contingencies . . . Nurse educators can no longer provide a sufficient knowledge base of facts to circumscribe professional nursing practice. No only are there far too many facts, but there are far too many facts which become erroneous over time. (Jones & Brown, 1991, p. 533).

Baker (1992) researched the perceptions of nursing faculty concerning factors which promote critical thinking in nursing students. She concluded that nursing faculty have a perception of what is required to practice nursing. However, "nurse educators are not taught how to teach critical thinking skills. Presently, there are few resources available to nursing educators to demonstrate how to develop critical thinking skills in the classroom or clinical areas " (Baker, 1992, p. 150).

In an editorial in the Journal of Nursing Education, Christine Tanner (1993) states:

> The new accreditation criteria, if they are implemented in the spirit in which they were developed, offer us the opportunity to explore ways that critical thinking abilities may be developed and to avoid trivializing important intellectual skills. In the press to prepare for an accreditation visit, faculty may be tempted to take the pathway we know best - to define critical thinking as nursing process, or to

> adopt a standard measure such as the Watson-Glaser Critical Thinking Appraisal as the outcome measure. But we will not have learned anything new from our own self-study about what we might do differently to help our students develop critical thinking, nor will we have engaged ourselves in one of the more important aspects of critical thinking - embracing the critical spirit, to have the disposition to engage in critical thinking about one's critical thinking. (p. 99)

Problem solving, by definition, requires the practitioner to identify the most important problem, gather information to explicate the problem, seek a solution to the problem, implement a solution, and evaluate the effectiveness of that solution.

> While this model is useful for certain aspects of nursing practice, we would argue that the practice of nursing is not so limited in its breadth and depth. Nursing decisions are the result of thinking processes, which involve negotiation between alternative points of view, contradictory lines of reasoning, and situational contexts. Critical thinking is a superordinate concept that includes problem solving. In nursing, the need for a knowledge-driven practice base is obvious. Nevertheless, it is difficult to determine precisely how much scientific knowledge is necessary and sufficient for the delivery of safe, effective patient care. Because learning is a life-long process, it is more important that nurses be taught to think rather than what to think. (Jones & Brown, 1993, p. 75)

Carole Brigham (1993) continued on the same theme.

> Nurses must possess a high level of critical thinking skills to practice nursing, now and in the future. Nurse educators must teach nurses to be critical thinkers.

> Nurses must be made aware of the thinking skills they use and continuously strive to attain a higher level of these skills. Teaching critical thinking requires a reduction of content. A reduction in content requires nurse educators to teach concepts and principals, not facts. Metacognition, or the reflecting on one's own thought processes, is necessary in the process of developing critical thinking skills. Therefore, nursing curricula must be reformed to overtly include the thought processes used by nurses and participatory learning activities if nurse educators are to develop a high level of critical thinking skills in nursing students. (p. 24)

In 1993, The Joint Commission for Accreditation of Health care organizations established standards that require nurses to participate actively in identifying opportunities for improving care and recommending, implementing, and evaluating actions to achieve improvement (Case, 1994). This standard describes the nurse engaging in critical thinking away from the patient's bedside (Case, 1994).

Bette Case (1994) stated:

> The primacy of critical thinking in nursing rests upon decision-making in nursing practice. Nursing judgment involves selecting and organizing pieces of data to support conclusions. The conclusions we reach lead us to choose and implement particular nursing actions from the host of possible nursing actions available to us. Although research has not consistently demonstrated a strong relationship between critical thinking and clinical judgment, characteristics of critical thinking match characteristics of sound clinical decision-making" (p. 101). Case

> continues, "Critical thinking goes before and beyond problem solving. In critical thinking, we emphasize the framing and reframing of the problem (before problem solving). In critical thinking, we also continue to evaluate the solution we choose, including reconsidering alternatives not chose initially that might become appropriate later as circumstances change (beyond problem solving). Problem solving, scientific method, and critical thinking all rely upon generating, testing, and assembling evidence to support a variety of solutions. (p. 104)

Since nursing is faced with facilitating and measuring the critical thinking process in direct relationship to nursing, a domain-specific critical thinking definition is necessary. However, there is a lack of agreement on the meaning of the concept; it is neither clearly understood nor systematically applied. The current definitions originate principally from philosophy and education and may not always be relevant to a practice discipline such as nursing. The lack of consensus and its relevancy to nursing impedes nurse educators who struggle with professional curricula and accreditation expectations to define and measure critical thinking in their curricula (Katoaka-Yahira & Saylor, 1994).

The conceptual definition of critical thinking, as described in the APA Delphi report (1990) contains clear reference to both skills and dispositional attributes applicable to nursing knowledge development. Developing a nursing knowledge base by carefully examining and delimiting key concepts/constructs and clarifying meanings, categorizing phenomena, identifying assumptions, testing relationships/hypotheses/theories, as well as conjecturing alternatives for testing,

justifying procedures, and stating findings are all manifestations of critical thinking skills needed for clinical decision-making in situations that are often high stakes and time limited (Facione & Facione, 1996).

The concern that nursing knowledge should expect a search for best knowledge in a given context is a central concern to nursing practice. Nursing practice demands fair-mindedness to new evidence and a willingness to reconsider clinical judgments. It values a focused and diligent approach to ill-structured patient problems, and requires tolerance of multiple perspectives and interpretations when such perspectives and interpretations can be supported by reasons and evidence. All these characteristics are identified as descriptors of ideal critical thinking disposition (Facione & Facione, 1996).

"Critical thinking can be characterized as purposeful, self-regulatory judgment, a human cognitive process. As such, critical thinking is a pervasive phenomenon that may be evident . . . in problem solving, professional practice, and everyday life" (Facione & Facione, 1996, p. 130).

> Educators should be able to use the language of this consensus definition to create teaching aids to engage students and clinicians in critical thinking. In a similar manner one should be able to create assessment devices to measure the critical thinking component of scientific presentations or demonstrations of clinical judgement. (Facione & Facione, 1996, p. 131)

The buzzword in today's graduate and undergraduate nursing education is "Critical Thinking." All levels of nursing students are expected to embrace and practice this concept in their professional roles. Utilizing critical thinking, the nurse is expected

to problem solve, develop ideas, and acquire knowledge in order to educate the public as well as other health care professionals (Klein, 1998).

Professionals are expected to exercise sound, unbiased judgment in interpreting and analyzing information, determining the nature of problems, identifying and evaluating alternative courses of action, making decisions, and throughout, monitoring the process and impact of their problem solving activity so as to amend, revise, correct, or alter their decisions, or any element that led up to those decisions, as deemed necessary. Judgment in professional practice, correctly exercised, is a reflective, self-corrective, purposeful thinking process which requires the professional to take into account content knowledge, context, evidence, methods, conceptualizations, and a variety of criteria and standards of adequacy (Facione, Facione, & Giancardo, 1998).

To become a professional nurse requires that you learn to think like a nurse. What makes the thinking of a nurse different from a doctor, a dentist, or an engineer? It is how nurses view the client and the type of problems nurses deal with in practice when they engage in client care. To think like a nurse requires that nurses learn the content of nursing; the ideas, concepts and theories of nursing and that they develop intellectual capacities and skills so that they, nurses, become disciplined, self-directed, critical thinkers (Critical Thinking, 1998). The nursing faculty at Cariboo, British Columbia, go on to state:

> Practitioners in nursing who are critical thinkers value and adhere to intellectual standards. Critical thinkers strive to be clear, accurate, precise, logical complete, significant and fair when they listen, speak, read, and write. Critical thinkers

> think deeply and broadly . . . As nurses, we want to eliminate irrelevant, inconsistent, and illogical thoughts as we reason about patient care. Nurses use language to clearly communicate in-depth information that is significant to nursing care (Critical Thinking, 1998, p. 1).

Critical Thinking Assessment in Nursing

Assessment in professional education relies almost exclusively on written and oral testing of a predetermined set of cognitive and analytical skills. This is consistent with the traditional view that professional activity consists of finding the unique solution of a well defined problem by means of these skills. Faculty can point to the fact that a good deal of assessment actually exists. It is assessment of the most traditional kind: Written courses and comprehensive examinations which test the students' grasp of basic principles and of pertinent facts. Elman and Lynton (1985) state, " We are beginning to recognize that this approach no longer is adequate to the complexity of modern society. Professional education and assessment must focus more on the process of defining problems and making instrumental judgements, using a variety of real and simulated clinical experiences" (p. 2). Elman and Lynton (1985) go on to state that any serious examination of assessment in higher education must evaluate the degree programs which are intended to prepare students for specific careers. Analysis of the role of assessment in undergraduate education must therefore pay a good deal of attention to the career oriented programs in our professional schools and departments .

A committee of the National Academy of Education, The Nation's Report Card, recommended in 1987 that there be a strong effort to develop subject-specific higher

order thinking tests (Ennis, 1993). Subject-specific critical thinking tests assess critical thinking within one standard subject matter area. A full understanding of any subject matter area requires that the person be able to think well in that area. However, as of summer, 1993, there were no subject-specific critical thinking tests (Ennis, 1993).

Janet Hickman (1993) conducted an assessment of critical thinking assessment in nursing education. She reviewed 24 studies of critical thinking in nursing education conducted between 1977 and 1990. Six studies presenting longitudinal data provided mixed findings regarding the impact of nursing education on critical thinking. Four of these studies found no significant gains in critical thinking over time. Nine studies presented cross-sectional data about nursing education and critical thinking ability. Six of those studies support the impact of nursing education on critical thinking. The other three studies demonstrated no significant differences between groups studied. Ten studies of critical thinking and clinical judgement presented mixed and contradictory results, varying from a weak positive relationship to no relationship. One study demonstrated a negative relationship between empathy and critical thinking ability. Hickman went on to state, "Research to identify the impact of nursing curricula on the development of critical thinking in students is still embryonic, as is the relationship between critical thinking and the formation of clinical judgements" (p. 46).

It is significant to note the lack of support for curricular impact on critical thinking:

> The Watson-Glaser CTA was developed to provide a sample of the ability to think critically about statements encountered in daily work, magazines, and

> newspapers. Consequently, it is not surprising that it would be difficult to show how a specific curriculum, course or teaching strategy affects such general critical abilities in a different context than what was studied in class (Watson, 1964, p. 10).

Hickman states, "This comment makes a strong and important point, especially in view of the fact that the majority of nursing research relies on the Watson-Glaser Critical Thinking Appraisal scores. It certainly provides a rationale for the mixed research findings related to nursing education and its impact on critical thinking" (p. 42). In summary, Hickman concluded:

> There is not a strong research base supporting a relationship between nursing curricula and critical thinking. It may be that this is due to lack of an appropriate instrument to measure critical thinking in nursing. Research related to skill and intellectual development suggests that critical thinking may be an unrealistic expectation . . . It is clear that research efforts should be directed at developing an appropriate instrument to measure critical thinking that occurs in nursing practice. (p. 46)

It is also significant to note, in Hickman's research summary of 24 studies of critical thinking in nursing education, only twelve studies included associate degree nursing students or graduates of associate degree nursing programs. None of the study samples were limited to only associate degree nursing students; of the twelve studies, all compared associate degree samples with diploma and/or baccalaureate samples. Three of the studies presented longitudinal data: Gross et al found no significant gain; Kentgen-

Andrews found no significant gain; and, Poole found an increase only in the low cognitive domain (Hickman, 1993). The other nine studies compared critical thinking and/or clinical judgment among various combinations of nursing program students. Baccalaureate nursing students seemed to consistently score higher on the Watson-Glaser Critical Thinking Appraisal tests. However, the results were mixed when comparing critical thinking and clinical judgment of associate degree nursing students with other nursing programs (diploma or baccalaureate) (Hickman, 1993).

In 1997, the National League for Nursing Accreditation published the Interpretive Guidelines for Standards and Criteria: 1997 Associate Degree Programs in Nursing. In these guidelines, Criterion #14 addresses educational effectiveness. Criterion 14 states: "The required outcomes and optional outcomes, as they relate to the program type, are evaluated" (NLN, 1998, p 2). The first of four "Required Outcomes" listed is critical thinking. The National League of Nursing's Interpretive Guidelines for Standards and Criteria: 1997 Associate Degree Programs in Nursing defines critical thinking as "How faculty define students' skills in reasoning, analysis, and decision-making relevant to the discipline of nursing" (NLN Glossary, 1998, p. 2).

"Outcomes," as defined by the NLN (1998), means "the evidence showing the degree to which course/or level purposes and objectives are or are not being attained and includes appropriate skills and competencies by students at the completion of their educational program" (p. 4 - 5). Examples of procedures for assessing an instructional program include the following, "Pre- and post-testing of students . . . as indicators of outcomes of critical thinking such as, California Critical Thinking Dispositions Inventory

and California Critical Thinking Skills Tests" (NLN, 1998, p. 4).

Noreen Facione (1997) reported the results of an analysis of a longitudinal aggregate data set comprising 145 predominately undergraduate samples contributed by on-site collaborative investigators at fifty programs of nursing education throughout the United States. This sample did not include associate degree nursing programs. The data analyzed were collected from 1992 through 1997. Significant relationships are reported between the California Critical Thinking Skills Test (CCTST) and a wide variety of academic achievement indicators (e.g. grade point average, standardized test scores), student descriptors (e.g. age, sex, RN-status, NCLEX [National Nursing Licensure Examination] passage), and program descriptors), e.g. student to faculty ratio, location of program, faculty focus on critical thinking in planning and curriculum development. Modest cross sectional increases and longitudinal gains are demonstrated in critical thinking skills. Initial percentile norms for the CCTST were calculated for nursing students by undergraduate class level (Facione, 1997).

Critical Thinking at Madison Area Technical College

Madison Area Technical College (MATC), along with other vocational technical colleges, is considered to be a "higher education institution" by North Central Association (NCA). NCA refined its understanding of general education and its relationship to the total curriculum and approved this statement of General Education:

> General Education is "general" in several clearly identifiable ways: It is not directly related to a student's formal technical, vocational, or professional preparation; it is part of every student's course of study, regardless of his or her

> area of emphasis, and it is intended to impart common knowledge, intellectual concepts, and attitudes that every educated person should possess. (Core Abilities and You, 1996, p. 1)

The Core Abilities . . . are intended to meet the NCA requirements and to better articulate MATC's commitment to equipping students to become productive, civic minded citizens. The original eight core abilities were developed by a state-wide General Education Task Force composed of representatives from all sixteen districts. They were further refined by the MATC Philosophy of General Education Committee, composed of representatives from all divisions of the College. The MATC Core Abilities, Liberal Studies, and Student Learning Outcomes Steering Committees have elaborated on these eight core abilities. General Education provides comprehensive instruction in all these areas; however, courses in occupational programs also address these abilities (Core Abilities and You, 1996).

> The eight Core Abilities are: Communication; Critical Thinking; Ethics; Global Awareness; Mathematics; Science and Technology; Self-Awareness; and Social Interaction. Critical Thinking is further defined: Students demonstrate critical thinking when they use multiple perspectives to:
>
> 1. Demonstrate observation skills
> 2. Identify a problem to be solved, task to be performed, or decision to be made.
> 3. Exhibit personal, professional, and academic honesty.
> 4. Recognize their responsibility to personal, social, professional, educational, and natural environments and make informed decisions based on that

responsibility.

5. Display behavior consistent with the ethical standards within a discipline or profession. (Core Abilities and You, 1996, p. 2)

Critical Thinking in Madison Area Technical College Associate Degree Nursing Program

The MATC Associate Degree Nursing Advisory committee, at the April, 1995 meeting, identified critical thinking skills as essential competencies for the Associate Degree Nursing graduate. In May, 1995, critical thinking skills were verified as essential competencies in the Associate Degree Nurse DACUM for Community Health Nurses (Develop A CurriculM, 1995). DACUM's are developed through a Continuous Improvement process to identify first competencies and then components to accomplish these competencies. The Community Health Nurses' DACUM was developed by staff nurses currently working in community health and, also, who were Associate Degree Nursing graduates.

On March 1, 1996, at an Associate Degree Nursing faculty retreat, critical thinking was identified as a major content thread to be carried as a priority through all four semesters of the Associate Degree Nursing program of instruction for Madison Area Technical College. The Program Evaluation committee continues to discuss how best to assess critical thinking in the program.

Summary

A review of the literature has shown the development of critical thinking as a well defined set of skills to be utilized not only in education but in life long learning, as a

member of a profession, and as a contributing citizen. Critical thinking is included in the national goals for education. The need for a nationalized standard for the assessment of critical thinking was made apparent by Nummedahl, Paul, and Facione. However, there are no subject-specific critical thinking tests. Within the profession of nursing, the assessment of critical thinking was made mandatory by the National League of Nursing, in 1989. Madison Area Technical College General Education division and the Associate Degree Nursing program both support core competencies in critical thinking.

Conclusions were reached that there is a strong relationship between nursing curriculum and critical thinking. Over 24 studies of assessment of critical thinking in nursing education were reviewed. Of these studies, only 12 included associate degree nursing students in their sample population, for the purpose of comparing the performance of associate degree nursing students with other levels of nursing students. Only three longitudinal studies were conducted with associate nursing students, with mixed results.

In 1997, the California Critical Thinking Skills Test was identified by the National League of Nursing as an appropriate instrument for assessment of critical thinking skills Facione reported upon a longitudinal aggregate data analysis of assessment of critical thinking skills in nursing students, using the California Critical Thinking Skills Test. The purpose of this study was to develop a standard for critical thinking skills for nursing students and nursing programs. However, associate degree nursing students were not included in this study. Other than these studies, assessment of critical thinking skills of associate degree nursing students is lacking. Assistance is

needed for associate degree nursing programs to set standards related to critical thinking outcomes for their educational programs. Formal studies are needed.

Chapter III

Methodology

Introduction

This chapter will describe the research hypotheses, the subjects under study, and how they were selected for inclusion in this study. In addition, the instruments being used to collect information will be discussed as to their content, validity, and reliability. Data collection and analysis procedures will then be described. The chapter will conclude with a discussion of methodology.

Research Hypotheses

The following hypotheses are proposed:

1. There will be an increase in the critical thinking skills of Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.
2. There will be an increase in the critical thinking skill subset "Analysis" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.
3. There will be an increase in the critical thinking skill subset "Evaluation" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College-Reedsburg.

4. There will be an increase in the critical thinking skill subset "Inference" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg.

5. There will be an increase in the critical thinking skill subset "Deductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg.

6. There will be an increase in the critical thinking skill subset "Inductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg.

Research Design

The study design is a combination of quasi-experimental and descriptive research. The study used a nonequivalent control group design format, as there was no random assignment to groups. The two groups were already in existence. The two existing groups were pre-tested; the MATC Associate Degree Nursing program was the treatment, the same two groups were post-tested. However, the researcher did not manipulate the independent variables (the nursing program). Thus, the study is descriptive research - describing what happens as a result of participating in the MATC Associate Degree Nursing program.

The MATC Associate Degree Nursing Advisory committee, at the April, 1995

meeting, identified critical thinking skills as essential competencies for the Associate Degree Nursing graduate. At this time, several faculty had participated in a Critical Literacy seminar as an inservice activity at MATC. However, critical thinking was not part of the program curriculum. Faculty did express the belief they were teaching students to think critically, although no formal instruction in critical thinking was included in the program plan.

On March 1, 1996, at an Associate Degree Nursing faculty retreat, ADN faculty spent an entire day learning about critical thinking, the application to nursing, and means for implementing instructional strategies related to critical thinking in nursing education. The faculty did not reach consensus regarding a definition for critical thinking. However, critical thinking was identified as a major content thread to be carried as a priority through all four semesters of the Associate Degree Nursing program of instruction for Madison Area Technical College. The actual implementation of this curricular plan did not take place until August, 1997. None of the participants in this current study participated in the revised curriculum, although faculty did increase their own perception and understanding of critical thinking. Some faculty were piloting critical thinking instructional exercises and were increasing their efforts to improve critical thinking in clinical situations.

Sample Description and Selection

A cohort of twenty-four students entering the Associate Degree Nursing program in August, 1995 and a second cohort of twenty four students entering in August, 1996, at the Madison Area Technical College - Reedsburg campus were selected as the sample for

Madison Area Technical College's Associate Degree Nursing program. Each entering class was selected through a randomized selection process from the first day applicants who fulfilled all the prerequisites for entry. The program has open enrollment to all applicants who meet the prerequisites. The prerequisites are: A minimum grade of C in a college level chemistry course and an algebra course, completion of the ACT test (however, no minimum score is required), and current certification in CPR (Cardio-Pulmonary Resuscitation). No qualified applicant was refused the right to participate in the randomized selection process conducted by the computer support services at Madison Area Technical College - Truax. However, the entering class size is limited to twenty-four students per year at the Reedsburg campus. The acceptance process for all program students is the same regardless of the campus to which they apply. No student who meets the program prerequisites is refused admittance. However, the student may be on a waiting list for one or two years, prior to entering the program.

Instrumentation

Demographic data, e.g. age, grade level of education upon entering program, highest level of education upon entering the program, high school graduation or GED, ACT score, and grade point average, was collected through the review of individual electronic student records by the researcher. Assessment data was collected through the use of the California Critical Thinking Skills Test Form A. The California Critical Thinking Skills Test was designed to be "a standardized assessment instrument targeting core critical thinking skills at the post-secondary level" (Coloney & Impara, 1994, p. 37). The California Critical Thinking Skills Test is based upon the American Philosophical

Association's Delphi consensus conceptualization of critical thinking. The California Critical Thinking Skills Test, designed for college students and adults, has publication dates from 1990 - 1992.

> According to the CCTST Fact Sheet (Facione, 1990), the CCTST measures the growth in CT skills which is an intended outcome of completing a college level general education CT course. Facione has collected considerable pre and post data, some quite cleverly by measuring post at the end of the first semester and pre with similar students at the beginning of the second semester. Gain runs between .04 and 1.45 in mean scores on a 34-item test, statistically significant with large samples. The total score has moderate to good reliability. (Conoley & Impara, 1994, p. 38 - 39)

William B. Michael, Professor of Education and Psychology, University of Southern California, Los Angeles, California, adds the following:

> The CCTST would appear to possess substantial content validity - perhaps more than any other competing instrument in light of the collective wisdom of the eminent scholars who contributed to its development. The resulting score distributions, which are normal in form, provide a basis for differentiating quite adequately among the examinees. The 34 items are not easy. On the pretest the highest score for the sample of students studied was 29, and on the post-test 31 with a respective means of 15.89 ad 17.27. There may be some concern relative to the 45-minute time limit. (Conoley & Impara, 1994, pp. 39 - 40)

Robert F. McMorris, Professor of Educational Psychology and Statistics, State University

of New York at Albany, Albany, New York, also addressed content validity in his review of the CCTST: "Test users are urged to study the items to judge validity, especially to estimate whether the test meets their conceptualizations of critical thinking" (Conoley & Impara, 1994, p. 38).

In 1995, the CCTST was selected as the instrument for this study because it had substantial content validity. The 45-minute time limit also made it possible to administer the instrument within the 50-minute confines of the MATC classroom structure. In 1998, the National League of Nursing identified pre- and post-testing of nursing students using the CCTST as an indicator of outcomes of critical thinking in self-studies for accreditation of nursing programs.

Data Collection

The California Critical Thinking Skills Test Form A was administered to the entering Associate Degree Nursing class in August, 1995 and August, 1996, prior to the beginning of program instruction. The California Critical Thinking Skills Test Form A was also administered at the completion of the program, May, 1997 and May, 1998. The test was administered after the last day of classes but prior to final exams. The test was administered by the researcher at the Madison Area Technical College - Reedsburg campus. The procedures for implementation in The California Critical Thinking Skills Test Form A test manual were followed.

Data Analysis

The collected data were entered into a spreadsheet, using Excel software. The spreadsheet was designed to analyze the data according to frequencies and ranges for

each item. For determining pre- and post-test differences, nominal statistical analysis was conducted through the use of Minitab for a t-test of differences.

Limitations

Students transferring to this program from either another Madison Area Technical College campus or from another nursing program were not included in the sample. Students who were admitted at a level other than entry level of the program or with advanced standing were not included in the sample.

The sample was limited to those students who remained in the program and who graduated from the program. Not all students who entered the program were able to complete the program. Students who transferred to another Madison Area Technical College campus or Associate Degree Nursing program were not included in the study.

Chapter Four

Results

Introduction

This chapter will present the results of assessment of the degree of change in critical thinking skills of Associate Degree Nursing students at Madison Area Technical College. The demographic information and descriptive statistics will be reported first. Data collected on each of the research hypotheses will then be given.

Demographic Data

Sample A of this study consisted of twenty Associate Degree Nursing students from the Madison Area Technical College - Reedsburg campus. Twenty-four students entered the program in August, 1995. Twenty-one students (87.5%) graduated from the program in May, 1997. One student did not complete the post-test. No transfer students from other Associate Degree Nursing programs or other Madison Area Technical College campuses or advance placement students were included in this study. Twenty-four students (100%) completed the pretest; twenty students (83.3%) completed the post-test. (See Table 1: Sample Population).

Sample B of this study consisted of twenty-three Associate Degree Nursing students from the Madison Area Technical College - Reedsburg campus. Twenty-four students entered the program in August, 1995. Twenty-three students (95.8 %) graduated from the program in May, 1997. No transfer students from other Associate Degree Nursing programs or other Madison Area Technical College campuses or advance

placement students were included in this study. Twenty-three students (95.8%) completed the pretest; twenty-three students (95.8%) completed the post-test. (See Table 1: Sample Population).

Table 1

Sample Population

Group	Number Entering	Number Graduating	Number Taking Pre-test	Number Taking Post-test
Sample A	24	21	24	20
Sample B	24	23	23	23

Sample A consisted of nineteen females (95.0 %) and one male (5.0 %). The average age of entering students in Sample A was 35.95 years with a range in age from 23 to 50. (See Table 2: Sample Age). Sample B consisted of twenty two females (95.65 %) and one male (4.34 %). The average age of entering students in sample B was 31.17 with a range in age from 21 to 47. (See Table 2: Sample Age).

Table 2

Sample Age

		Sex				
Group	N	M	F	Mean Age	Minimum Age	Maximum Age
Sample A	20	1	19	35.95	23	50
Sample B	23	1	22	31.17	21	47

Student registration requires students to report the highest level of education completed by grade level. For Sample A, the highest level of education by grade level

reported by students upon program entry was grade 16; the lowest level of education by grade level reported by students upon program entry was grade 12. The mean level of education by grade level upon entry was 12.850. (See Table 3: Highest Level of Education by Grade Level).

For Sample B, the highest level of education by grade level reported by students upon program entry was grade 16; the lowest level of education by grade level reported by students upon program entry was grade 12. The mean level of education by grade level reported by students upon program entry was 13.391. (See Table 3: Highest Level of Education by Grade Level).

Table 3

Highest Level of Education by Grade Level

		Grade Level			
Group	N	Mean	Median	Minimum	Maximum
Sample A	21	12.850	12.500	12	16
Sample B	23	13.391	13.000	12	16

Students were required to submit ACT test scores prior to application for admission to the Associate Degree Nursing program. The ACT scores for Sample A ranged from a minimum of 14 to a maximum of 25. Sample A students had a mean score of 20.35 for the ACT. The ACT scores for Sample B ranged from a minimum of 14 to a maximum of 29. Sample B students had a mean score of 20.13 for the ACT.

Final cumulative grade point averages were collected for Sample A and Sample B. The mean grade point average for Sample A was 3.1465, with a range from 2.61 to

3.95; the mean grade point average for Sample B was 2.8961, with a range from 2.36 to 3.86. (See Table 5: Cumulative Grade Point Average).

Table 4

ACT Scores

		ACT Results				
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Sample A	21	20.35	21.00	2.996	14	25
Sample B	23	20.13	20.00	3.209	14	29

Table 5

Cumulative Grade Point Average

		Cumulative Grade Point Average				
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Sample A	20	3.1465	3.0550	0.3999	2.61	3.95
Sample B	23	2.8961	2.8900	0.3549	2.36	3.86

Comparisons of Samples A and B

Sample A as a group was compared to Sample B as a group using a two-sample t-test. The mean age of Sample A was compared to the mean age of Sample B using a two sample t-test. Sample A students had a mean age of 35.95; Sample B students had a mean age of 31.17. The t value was 1.89. Sample A students were slightly older than Sample B students; however, this difference was not statistically significant. (See Table 6: Comparison of Samples A and B).

The mean level of education by grade level reported by students in Sample A was compared to the mean level of education by grade level reported by students in Sample B using a two sample t-test. Sample A students had a mean grade level of 12.85 and Sample B students had a mean grade level reported of 13.39. Highest level of education by grade level for Sample B was slightly higher than Sample A. The t-value was -1.36; there was no statistical significance. (See Table 6: Comparison of Samples A and B).

The mean ACT score of Sample A was compared to the mean age of Sample B using a two sample t-test. Sample A ACT scores had a mean of 20.35 and Sample B ACT scores had a mean of 20.13. ACT scores were almost identical for both groups and there was no significant difference. (See Table 6: Comparison of Samples A and B).

Table 6

Comparison of Samples A and B

	Sample A		Sample B			
Comparison	N	Mean	N	Mean	t-test	Probability
Age	20	35.95	23	31.17	1.89	0.065
Highest Level of Education	20	12.85	23	13.39	-1.36	0.28
ACT Score	20	20.35	23	20.13	0.23	0.82
Grade Point Average	20	3.146	23	2.896	2.16	0.037

The mean grade point average of Sample A was compared to the mean grade point average of Sample B using a two sample t-test. Sample A students had a mean grade point average of 3.146 and Sample B students had a mean grade point average of 2.896. The grade point average for Sample A was significantly higher (0.25 higher) than

Sample B's grade point average. (See Table 6: Comparison of Samples A and B). Anecdotally, faculty reported Sample A to be a more motivated group than Group B. Group B, as a whole, was perceived to have poorer study skills, less motivation to study, worked too much, and tested poorly.

California Critical Thinking Skills Test Data

Possible scores on the instrument, the California Critical Thinking Skills Test (CCTST), are a Total score from 1 to 34. Sub-scale scores on the instrument can range as follows: Analysis (1 to 9); Evaluation (1 to 14); Inference (1 to 11); Deductive Reasoning (1 to 16); and Inductive Reasoning (1 to 14). The sum of the three Delphi construct scores - analysis, evaluation, and inference - is equal to the total score (Facione and Facione, 1992).

Research Results

Pre-test Scores

The instrument, the California Critical Thinking Skills Test (CCTST), was administered as a pre-test, prior to classroom instruction in the Associate Degree Nursing program. The CCTST pre-test mean Total score for Sample A was 14.95. Their Total test scores ranged from 11 as a minimum to 21 as a maximum. Sample A's subset Analysis had a mean score of 4.250. Their Analysis scores ranged from 2 as a minimum to 7 as a maximum. Sample A's subset Evaluation had a mean score of 5.00. Their Evaluation test scores ranged from 1 to 9. The subset Inference had a mean score of 5.850. The Inference test scores ranged from 3 to 9. Sample A's subset Deductive Reasoning had a mean score of 7.050, with test scores ranging from 3 to 12. The subset

Inductive Reasoning had a mean score of 6.450 and test scores ranging from 2 to 11. (See Table 7: Sample A CCTST Pre-test Scores).

Table 7

Sample A CCTST Pre-test Scores

		Sample A Pre-test Scores				
Test Area	N	Mean	Median	Standard Deviation	Minimum	Maximum
Total	20	14.95	14	3.252	11.000	21.000
Analysis	20	4.250	4	1.333	2.000	7.000
Evaluation	20	5.000	5.000	2.176	1.000	9.000
Inference	20	5.850	6.000	1.496	3.000	9.000
Deductive Reasoning	20	7.050	6.000	2.523	3.000	12.000
Inductive Reasoning	20	6.450	6.500	2.188	2.000	11.000

The CCTST pre-test mean Total score for Sample B was 14.957. Their Total test scores ranged from 10 as a minimum to 20 as a maximum. Sample B's subset Analysis had a mean score of 4.348. Their Analysis scores ranged from 2 as a minimum to 6 as a maximum. Sample B's subset Evaluation had a mean score of 5.043. Their Evaluation test scores ranged from 2 to 9. The subset Inference had a mean score of 5.565. The Inference test scores ranged from 2 to 8. Sample B's subset Deductive Reasoning had a mean score of 7.565, with test scores ranging from 3 to 14. The subset Inductive Reasoning had a mean score of 5.870 and test scores ranging from 2 to 9. (See Table 8: Sample B CCTST Pre-test Scores).

Table 8

Sample B CCTST Pre-test Scores

		Sample B Pre-test Scores				
Test Area	N	Mean	Median	Standard Deviation	Minimum	Maximum
Total	23	14.957	15.000	2.992	10.000	20.000
Analysis	23	4.348	4.000	1.071	2.000	6.000
Evaluation	23	5.043	5.000	1.846	2.000	9.000
Inference	23	5.565	6.000	1.502	2.000	8.000
Deductive Reasoning	23	7.565	7.000	2.793	3.000	14.000
Inductive Reasoning	23	5.870	6.000	1.632	2.000	9.000

These results for pre-tests for both Sample A and Sample B are similar to those of a sample of freshman students entering BSN programs (Facione, 1997, p. 18). The average test score for BSN students was 14.5 as compared to 14.95 for Sample A and 14.957 for Sample B. This difference is not statistically significant. MATC has a more homogeneous student group than BSN students. Ranges for MATC students were 10 points, while freshman BSN students were 20 points. MATC's students had higher minimum total scores (11 and 10 for MATC versus 5 for BSN) and lower maximum scores than freshman BSN students (21 and 20 for MATC versus 25 BSN).

Post-test Scores

The instrument, the California Critical Thinking Skills Test (CCTST) was administered as a post-test prior to final examinations in the fourth and final semester of

the Associate Degree Nursing program. The CCTST post-test mean Total score for Sample A was 15.85. Their total test scores ranged from 11 as a minimum to 21 as a maximum. Sample A's subset Analysis had a mean score of 4.100. Their Analysis scores ranged from 1 as a minimum to 7 as a maximum. Sample A's subset Evaluation had a mean score of 6.450 Their Evaluation test scores ranged from 1 to 10. The subset Inference had a mean score of 5.300. The Inference test scores ranged from 0.00 to 9. Sample A's subset Deductive Reasoning had a mean score of 7.950, with test scores ranging from 3 to 14. The subset Inductive Reasoning had a mean score of 6.450 and test scores ranging from 1 to 10. (See Table 9: Sample A CCTST Post-test Scores).

Table 9

Sample A CCTST Post-test Scores

		Sample A Post-test Scores				
Test Areas	N	Mean	Median	Standard Deviation	Minimum	Maximum
Total	20	15.85	15.50	5.42	11.000	21.000
Analysis	20	4.100	4.000	1.651	1.000	7.000
Evaluation	20	6.450	6.500	2.724	1.000	10.000
Inference	20	5.300	5.000	2.250	0.000	9.000
Deductive Reasoning	20	7.950	8.000	3.486	3.000	14.000
Inductive Reasoning	20	6.450	7.000	2.212	1.000	10.000

The CCTST pos-test mean Total score for Sample B was 16.261. Their total test scores ranged from 10 as a minimum to 24 as a maximum. Sample B's subset Analysis

the Associate Degree Nursing program. The CCTST post-test mean Total score for Sample A was 15.85. Their total test scores ranged from 11 as a minimum to 21 as a maximum. Sample A's subset Analysis had a mean score of 4.100. Their Analysis scores ranged from 1 as a minimum to 7 as a maximum. Sample A's subset Evaluation had a mean score of 6.450 Their Evaluation test scores ranged from 1 to 10. The subset Inference had a mean score of 5.300. The Inference test scores ranged from 0.00 to 9. Sample A's subset Deductive Reasoning had a mean score of 7.950, with test scores ranging from 3 to 14. The subset Inductive Reasoning had a mean score of 6.450 and test scores ranging from 1 to 10. (See Table 9: Sample A CCTST Post-test Scores).

Table 9

Sample A CCTST Post-test Scores

		Sample A Post-test Scores				
Test Areas	N	Mean	Median	Standard Deviation	Minimum	Maximum
Total	20	15.85	15.50	5.42	11.000	21.000
Analysis	20	4.100	4.000	1.651	1.000	7.000
Evaluation	20	6.450	6.500	2.724	1.000	10.000
Inference	20	5.300	5.000	2.250	0.000	9.000
Deductive Reasoning	20	7.950	8.000	3.486	3.000	14.000
Inductive Reasoning	20	6.450	7.000	2.212	1.000	10.000

The CCTST post-test mean Total score for Sample B was 16.261. Their total test scores ranged from 10 as a minimum to 24 as a maximum. Sample B's subset Analysis

had a mean score of 4.739. Their Analysis scores ranged from 2 as a minimum to 8 as a maximum. Sample B's subset Evaluation had a mean score of 5.696. Their Evaluation test scores ranged from 2 to 11. The subset Inference had a mean score of 5.783. The Inference test scores ranged from 3 to 9. Sample A's subset Deductive Reasoning had a mean score of 7.652, with test scores ranging from 3 to 13. The subset Inductive Reasoning had a mean score of 6.696 and test scores ranging from 3 to 11. (See Table 10: Sample B CCTST Post-test Scores).

Table 10

Sample B CCTST Post-test Scores

		Sample B Post-test Scores				
Test Area	N	Mean	Median	Standard Deviation	Minimum	Maximum
Total	23	16.261	16.000	4.741	10.000	24.000
Analysis	23	4.739	5.000	1.421	2.000	8.000
Evaluation	23	5.696	4.000	2.601	2.000	11.000
Inference	23	5.783	6.000	1.858	3.000	9.000
Deductive Reasoning	23	7.652	8.000	2.994	3.000	13.000
Inductive Reasoning	23	6.696	7.000	2.098	3.000	11.000

Total CCTST mean scores were reported by Facione (1997, p. 19 - 21) for sophomore (15.7), junior (16.11), and senior (16.4) BSN students. These compare to mean total scores of 15.85 and 16.261 for the graduating MATC ADN students. Facione suggests the CCTST scores should increase as students progress through nursing

programs. However, she adds: "We might see the same effect if a proportion of the weaker students are leaving along the way" (p. 20). Facione went on the state: "The definitive analysis needed to determine gains over the course of a nursing program is paired t-test of the pre-test and post-test scores for the same individuals" (p. 20).

Change in Individual Thinking Skills

To assess the change in thinking skills, the pre-test CCTST scores were compared to the post-test CCTST scores. The comparison was made by subtracting the pre-test score from the post-test score for each individual. The resulting change scores were analyzed with the t-test of differences.

Sample A student scores showed a change in total thinking skills of 0.900 between pre- and post-test scores on the CCTST. Their t-test of differences t-value for total thinking skills was 0.93. This t-value is not significant at the .05 level. In other words, there is no statistically significant gain in thinking skills during the program as measured by the total score. Sample A student scores showed a change in Analysis thinking skills of -0.150 between pre- and post-test scores on the CCTST. This indicates a decrease in analysis thinking skills. This was not significant. Student scores for sample A showed a change in Evaluation thinking skills of 1.450 between pre- and post-test scores on the CCTST. Their t-test of differences t value for Evaluation thinking skills was 2.29. This was significant at the .05 level. In other words, this indicates a significant increase in evaluation thinking skills for Sample A. Sample A student scores showed a change in Inference thinking skills of -0.550 between pre- and post-test scores on the CCTST. This was a decrease in Inference thinking skills. This was not

significant. Sample A student scores showed a change in Deductive Reasoning skills of 0.900 between pre- and post-test scores on the CCTST. Their t-test of differences t value for Deductive Reasoning was 1.66. This change was not significant. Sample A student scores showed no change in Inductive Reasoning skills. (See Table 11: Sample A Change in Critical Thinking Test Scores).

Table 11

Sample A Change in Critical Thinking Test Scores

		Change in Critical Thinking			
Test Area	N	Mean Change	Standard Deviation	t	P
Total CCTST	20	0.900	4.315	0.93	0.36
Analysis Subset	20	-0.150	1.531	-0.44	0.67
Evaluation Subset	20	1.450	2.837	2.29	0.034
Inference Subset	20	-0.550	2.305	-1.07	0.30
Deductive Reasoning Subset	20	0.900	2.426	1.66	0.11
Inductive Reasoning Subset	20	No change	3.009	0.00	1.00

Sample B student scores showed a change in total thinking skills of 1.304 between pre- and post-test scores on the CCTST. Their t-test of differences t value for total thinking skills was 2.17. This was significant at the .05 level. In other words, this indicates a significant increase in total thinking skills for Sample B. Sample B showed a change in Analysis thinking skills of 0.390 between pre- and post-test scores on the CCTST. This indicates a minimal change in analysis thinking skills. This was not significant. Sample B student scores showed a change in Evaluation thinking skills of

0.652 between pre- and post-test scores on the CCTST. Their t-test of differences (t) scores for total thinking was 1.71. This change was not significant. Sample B student scores showed a change in Inference thinking skills of 0.217 between pre- and post-test scores on the CCTST. Their t-test of differences t value for Inference thinking was 0.49. This change was not significant. Sample B student scores showed a change in Deductive Reasoning skills of 0.087 between pre- and post-test scores on the CCTST. Their t-test of differences t values for Deductive Reasoning 0.16. This was not a significant change. Sample B student scores showed a change in Inductive Reasoning skills of 0.826 between pre- and post-test scores on the CCTST. Their t-test of differences t values for Inductive Reasoning 2.30. This was significant at the .05 level. In other words, this indicates a significant increase in inductive reasoning skills for Sample B. (See Table 12: Sample B Change in Critical Thinking Test Scores).

Table 12

Sample B Change in Critical Thinking Test Scores

		Change in Critical Thinking			
Test	N	Mean	Standard Deviation	t	P
Total CCTST	23	1.304	2.883	2.17	0.041
Analysis Subset	23	0.390	1.588	1.18	0.25
Evaluation Subset	23	0.652	1.824	1.71	0.10
Inference Subset	23	0.217	2.110	0.49	0.63
Deductive Reasoning Subset	23	0.087	2.610	0.16	0.87
Inductive Reasoning Subset	23	0.826	1.723	2.30	0.031

The change score results for both Sample A and Sample B are higher than those reported for BSN programs. Facione (1997) reported the change in scores for 625 students with pre-test and post-test scores. The post-test mean for BSN students was 0.68 higher than pre-test mean. Facione stated: "The gain of nearly one question, represents meaningful movement when one considers the difficulty of the instrument and the effort involved in pushing a 625 undergraduate student mountain one click in the positive direction" (p. 25). In comparison, MATC's total thinking mean showed a change of .90 for Sample A and 1.304 for Sample B.

Correlations between ACT, GPA, and Thinking Test Scores

Pearson's product moment correlation was used to measure the correlations between ACT, Grade Point Average (GPA), pre-test, post-test, and pre-/post-tests. ACT scores, with one exception, had a higher correlation with critical thinking skills than cumulative grade point averages. In addition, the correlations were moderate (.4 to .6) to low (.2 to .39). (See Table 13: Correlations).

The mean CCTST pre-test scores of Sample A were compared to the mean CCTST pre-test scores of Sample B using a two sample t-test. Pre-test thinking skills scores were almost identical for the two groups. The t value was -0.01 and was not significant. (See Table 14: Correlations of Pre-test and Post-test Scores).

The mean CCTST post-test scores of Sample A were compared to the mean CCTST post-test scores of Sample B using a two sample t-test. There was no significant difference in post-test thinking skills scores between the two groups. (See Table 14: Correlation of Pre-test and Post-test Scores).

Table 13

Correlations

	Sample A		Sample B	
	GPA	ACT	GPA	ACT
GPA		0.359		0.222
Pre-test	0.275	0.558*	0.398*	0.408*
Post-test	0.603*	0.474*	0.298	0.455*
Pre-/Post-test	0.389*	0.213	0.068	0.325

* A correlation coefficient of .36 or larger is significant at the .05 level. Another words, there is a significant relationship between the two values.

Pre-test and post-test scores for Sample A and Sample B were compared. The comparison were between groups with two-sample t-tests to determine if there were any significant starting and ending differences. Sample A had a mean change of +.9 for total thinking skills and Sample B had a mean change of +1.304 for total thinking skills. (See Table 14: Comparisons of Pre-test and Post-test Scores).

Table 14

Comparisons of Pre-test and Post-test Scores

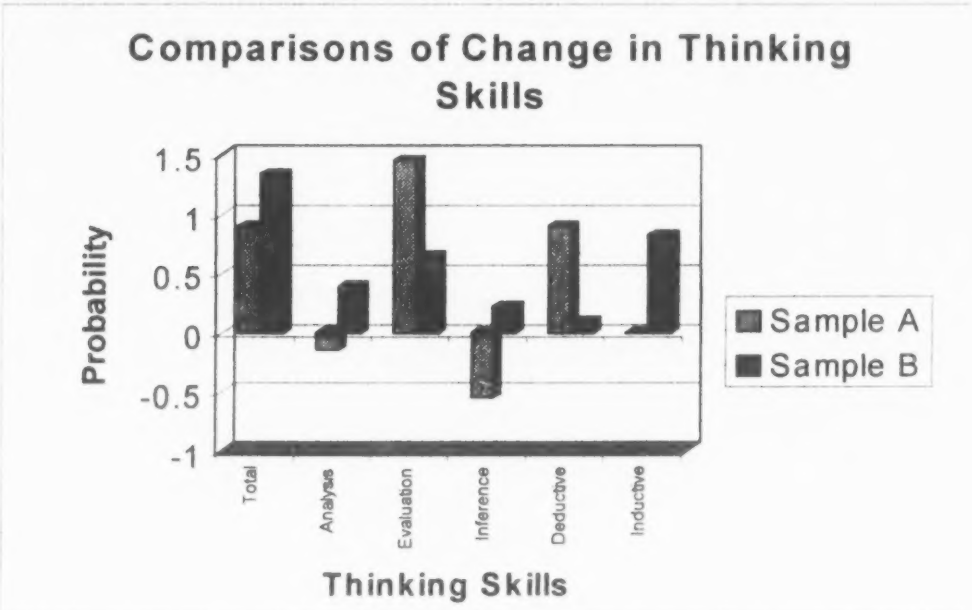
	Sample A		Sample B			
	N	Mean	N	Mean	t-test	Probability
Pre-test Scores	20	14.95	23	14.96	-0.01	0.99
Post-test scores	20	15.85	23	16.26	-0.26	0.99

Sample A had a mean change of -.15 for Analysis thinking skills; Sample B had a mean change of +.39 for Analysis thinking skills. Sample A had a mean change of +1.45 for Evaluation thinking skills; Sample B had a mean change of +.65 for Evaluation thinking

skills. Sample A had a mean change of -.55 for Inference thinking skills; Sample B had a mean change of +.217 for Inference thinking skills. Sample A had a mean change of +.9 for Deductive Reasoning skills; Sample B had a mean change of +.087 for Deductive Reasoning skills. Sample A had no change for Inductive Reasoning skills; Sample B had a mean change of +.826 for Inductive Reasoning skills. (See Figure A: Comparisons of Change in Thinking Skills).

Figure A

Comparisons of Change in Thinking Skills



Sample A had a significant increase in Evaluation thinking skills. Sample B had a significant increase in Total thinking skills. A significant increase was also shown in the subset of Inductive Reasoning. Sample B had positive gains in all subset thinking

tests, while Sample A had decreases in two areas of thinking tests (Analysis and Inference). (See Table 15: Analysis of Thinking Skills Scores).

Table 15

Analysis of Thinking Skills Change Scores

	Sample A		Sample B	
Test Change Scores	Mean	P	Mean	P
Total CCTST Score	+.9	0.36	+1.304	0.041
Analysis Subset	-.15	0.67	+.39	0.25
Evaluation Subset	+1.45	0.034	+.65	0.10
Inference Subset	-.55	0.30	+.217	0.63
Deductive Reasoning Subset	+.9	0.11	+.087	0.87
Inductive Reasoning Subset	0.00	1.00	+.826	0.031

Table 16

Significance of Thinking Skills Scores

	Sample A		Sample B	
Test	Mean	Significance	Mean	Significance
Total CCTST Score	+.9	Not Sig	+1.304	Significant Increase
Analysis Subset	-.15	Not Sig	+.39	Not Sig
Evaluation Subset	+1.45	Significant Increase	+.65	Not Sig
Inference Subset	-.55	Not Sig	+.217	Not Sig
Deductive Reasoning Subset	+.9	Not Sig	+.087	Not Sig
Inductive Reasoning Subset	0.00	Not Sig	+.826	Significant Increase

The results of the degree of difference in the sub-sets CCTST mean post-test scores and the pre-test scores in MATC ADN students were significant in the sub-sets Evaluation and Inductive Reasoning. Facione (1997, p. 27) also reports gains in the sub-sets Evaluation and Inductive Reasoning for 625 BSN students.

Summary

Neither group had significant changes in the areas of Analysis, Inference, or Deductive thinking skills. Group A had a significant increase in Evaluation skills. Group B had a significant increase in total scores and Inductive Reasoning. In addition, Group B had positive gains in all of the sub-tests. The significance level used was .05. (See Table 16: Significance of Thinking Skills Scores).

Chapter 5

Summary, Conclusions, and Recommendations

Introduction

The study was a comparative study of two groups of Associate Degree Nursing students at Madison Area Technical College - Reedsburg. The study focused on the change in critical thinking skills as they progressed through their educational process at Madison Area Technical College - Reedsburg.

Summary

Critical thinking is a major component of nursing education. Programs in nursing must assess critical thinking as a required outcome for national accreditation by the National League for Nursing. In March, 1996, Madison Area Technical College Associate Degree Nursing faculty identified critical thinking as a major content thread to be carried as a priority for instruction through all four semesters of the Associate Degree Nursing program.

The purpose of this study was to determine the degree of change in critical thinking skills in Associate Degree Nursing students as they progress through their educational process at Madison Area Technical College. Cohorts of twenty-four students, entering the Associate Degree Nursing program at Madison Area Technical College - Reedsburg campus, in August, 1995 and August, 1996 and graduating in May, 1997 and May, 1998, comprised the samples. The California Critical Thinking Skills Test - Form A (CCTST) was administered to the entering Associate Degree Nursing class

in August of 1995 and in August of 1996 - prior to the beginning of program instruction. The California Critical Thinking Skills Test Form A was also administered at the completion of the program of study (May, 1997 and May, 1998). The California Critical Thinking Skills Test - Form A was administered by the researcher at the Madison Area Technical College - Reedsburg campus.

To assess the degree of change in thinking skills, the pre-test CCTST scores were compared to the post-test CCTST scores. The comparison was made by subtracting the pre-test score from the post-test score for each individual. The resulting change scores were analyzed with the t-test of differences.

The major outcome of this study was to identify CCTST pre- and post-testing of MATC's ADN students as a viable means of assessing their change in critical thinking skills. One group showed a significant increase in the total score for the CCTST, based on positive gains in their scores for the five sub-tests that impacted the total score. Further outcomes were to identify a significant change in both evaluation and inductive reasoning thinking skills in the two groups of students: One group showed a significant increase in evaluation thinking skills; the other group had a positive gain in evaluation thinking skills, although it was not statistically significant. One group showed a significant increase in the critical thinking skill subset Inductive Reasoning. An additional benefit of the study was to identify limited, if any, change in analysis, inference, and deductive thinking skills in the program students. These areas of limited change then become areas to be further evaluated by the ADN program.

Conclusions

The conclusions of this study were based on the following research hypotheses.

1. There will be an increase in the critical thinking skills of Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg. Sample B showed a significant increase in the total score for the CCTST. This was based on positive gains in their scores for the five sub-tests that impacted the total.

2. There will be an increase in the critical thinking skill subset "Analysis" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College - Reedsburg. There was no significant change in the critical thinking skill subset Analysis for either group.

3. There will be an increase in the critical thinking skill subset "Evaluation" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College-Reedsburg. Sample A showed a significant increase in the critical thinking skill subset Evaluation. Although the gain was not statistically significant, Sample B did have a positive gain in Evaluation thinking skills.

4. There will be an increase in the critical thinking skill subset "Inference" in Associate Degree Nursing students from entry to completion of the

Associate Degree Nursing program at Madison Area Technical College - Reedsburg. There was no significant change in the critical thinking skill subset Inference for either group.

5. There will be an increase in the critical thinking skill subset "Deductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg. There was no significant change in the critical thinking skill subset Deductive Reasoning for either group.

6. There will be an increase in the critical thinking skill subset "Inductive Reasoning" in Associate Degree Nursing students from entry to completion of the Associate Degree Nursing program at Madison Area Technical College- Reedsburg. Sample B showed a significant increase in the critical thinking skill subset Inductive Reasoning.

Further conclusions of this study were based on the following research objectives.

Research Objective Number 1

Research Objective Number 1 was to determine the degree of change in critical thinking skills in Associate Degree Nursing students at Madison Area Technical College - Reedsburg. This research showed mixed results. One group had significant change in total critical thinking skills. The other group had a positive change in total thinking skills, but it was not statistically significant. However, both groups showed significant change in evaluation thinking skills, and inductive reasoning skills. The comparison was made by subtracting the pre-test score from the post-test score for each individual. The

resulting change scores were analyzed with the t-test of differences.

Research Objective Number 2

Research Objective Number 2 was to assess the feasibility of using the California Critical Thinking Skills Test Form A (CCTST) to develop performance standards related to critical thinking for Madison Area Technical College Associate Degree Nursing program. It is feasible to use the CCTST to assess performance standards related to critical thinking for the Madison Area Technical College Associate Degree Nursing program. The CCTST has been identified by the National League for Nursing as a means of assessment of change in critical thinking skills. The CCTST is a standardized test, which can be made available throughout the district. The length of the test fits within the constraints of class periods. The placements of the tests at the beginning and end of the program fit within program schedules and class timetables. The directions to test administrators and to students are easily understood and implemented. The conditions for testing are easily met within the Madison Area Technical College campus environments.

The concept of the assessment of critical thinking in nursing students is new to the national nursing accreditation process. ADN programs throughout Wisconsin and the nation are struggling with the need to validate a change in critical thinking skills in nursing students. Assessment of critical thinking skills is to be the focus of the annual Associate Degree Nursing program statewide conference being held April, 1999.

Meanwhile, the MATC ADN program is in the process of reaching a consensus definition for critical thinking (the first step for the accreditation process) and then in

completing curriculum revision and implementation, which includes instructional methods to promote critical thinking. The ADN program curriculum committee has identified the need to assist all program faculty to better understand how to implement critical thinking as a priority for the 1999 - 2000 school year.

Recommendations

The following recommendations are made based on the results of this study:

1. Due to the conclusions reached by this study, it is recommended that the CCTST be administered as a pre-test and post-test to all students in the Associate Degree Nursing program at Madison Area Technical College.
2. It is recommended that Madison Area Technical College increase its curriculum to strengthen Analysis, Inference, and Deductive Reasoning thinking skills.
3. Research should be continued with further cohorts of students in the Associate Degree Nursing program at Madison Area Technical College. Further longitudinal studies need to be conducted to determine the degree of difference in critical thinking skills between students in the old curriculum and the students in the new curriculum. This continued research gains importance since the program curriculum had significant changes beginning in August, 1997 to include Critical Thinking as a continuing thread throughout all four semesters of the program. Significant curricular changes have been made to implement critical thinking.

Recommendations for Additional Research

The following recommendations would be of further benefit to Associate Degree Nursing education:

1. Formal studies are needed to develop a standard for critical thinking skills for Associate Degree Nursing students and Associate Degree Nursing programs. In 1997, the California Critical Thinking Skills Test was identified by the National League of Nursing as an appropriate instrument for assessment of critical thinking skills. Facione (1997) reported upon a longitudinal aggregate data analysis of assessment of critical thinking skills in baccalaureate and graduate nursing students, using the California Critical Thinking Skills Test. Associate Degree Nursing students were not included in this study. Assistance is needed for Associate Degree Nursing programs to set standards related to critical thinking outcomes for their educational programs.

2. Formal studies are needed to test the hypothesis that what nursing faculty is doing in relation to critical thinking and the curriculum will have an effect on students' success in Associate Degree Nursing programs. Activities of programs or faculty in relation to critical thinking might include:

Adopting a critical thinking focus for the program.

Discussing with faculty members the meaning of critical thinking.

Planning to make curricular changes to enhance critical thinking.

Implementing curricular changes.

Requiring a designated critical thinking course.

Analyzing critical thinking test score data relative to critical thinking outcomes.

Interpreting critical thinking test score data for purposes of teaching or curricular development. (Facione, 1997, p. 42).

Facione (1997) has conducted extensive research related to the effect of faculty and program involvement with critical thinking for baccalaureate and graduate nursing student success. However, little research has been conducted which includes Associate Degree Nursing programs.

3. Further research needs to conducted to determine the correlation between successful completion of the National Licensure Examination for Registered Nurses and critical thinking ability.

4. Further research needs to be undertaken to assess the affect of student motivation, placement of testing, students' regard for faculty, and students' understanding of the application of outcomes upon the pre-test and post-test scores. Students exiting the program may in particular give less than their best effort on an ungraded test and instead be focused upon their professional future and specifically in a job placement.

5. It would be useful to conduct a concurrent validity check on the critical thinking skills test for the MATC ADN program. For example, assessment situations/simulations for nursing skills/nursing cares which evaluate critical thinking skills need to be developed for the program. Then, a comparison could be made between student's performance in these situations and their CCTST scores.

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Appendix A

Validation of the

California Critical Thinking Skills Test

The following are summaries of reviews of the California Critical Thinking Skills Test in further support of its validity as an assessment of critical thinking. First of all, a review of the California Critical Thinking Skills Test by Robert F. McMorris, Professor of Educational Psychology and Statistics, State University of New York at Albany, Albany, New York:

> In Roget's Thesaurus (Chapman, 1992, p. 842), a synonym given for "critical" is "crucial." Certainly critical thinking skills are crucial for individuals and society, and developing an appropriate test to assess critical thinking skills is no trivial task. The California Critical Thinking Skills Test (CCTST) contains 34 multiple-choice items with a 45 minute time limit. The items cover a variety of topics: Some items are realistic, providing high face validity, but they potentially confound reasoning with content; and some are "nonsense," content-free items for those who prefer a more abstract approach. The items seem reasonably interesting.
>
> A Delphi panel developed a consensus definition of critical thinking (CT), core CT skills with examples, and dispositions crucial to becoming a critical thinker. The test contains three subscores based on the panel's work: Analysis, Evaluation, and Inference. The developer, Facione, also apologetically offers two other subscores, Deductive Reasoning and Inductive Reasoning, based on 30 of the 34 items, to meet a California State University objective. (Given the double use of most items, we will refer to subscores rather than subtests.)
>
> The developer conducted several studies using the CCTST at California State in Fullerton involving 1,196 undergraduates, 20 instructors, 5 different courses, and

three academic departments. These data are bases for validity, reliability, and norm information.

VALIDITY. Test users are urged to study the items to judge validity, especially to estimate whether the tests meets their conceptualizations of critical thinking. (Conoley & Impara, 1994, p. 37 - 39).

According to the CCTST Fact Sheet (Facione, 1990), "The CCTST measures the growth in CT skills which is an intended outcome of completing a college level general education CT course." Facione has collected considerable pre and post data, some quite cleverly by measuring post at the end of the first semester and pre with similar students at the beginning of the second semester.

Gain runs between .04 and 1.45 in mean scores on a 34-item test, statistically significant with large samples.

Pretest scores correlate with college GPA (.20), SAT-V (.55), SAT-M (.44), most Nelson-Denny Reading scores (.40s), and post-test scores (.70). In general, these correlations with tests and with grades seem reasonable and supportive. (Facione, 1990, p. 8).

Facione may emphasize statistics instead of meanfulness in examining gender differences . . . Yet the mean difference pre and post are almost equal and hardly impressive (about 3/4 point). The difference in sample size - 479 [students] for pre and 710 [students] post - helps in estimating why the posttests differ statistically by gender.

Another way to consider validity is through multi trait-multi method matrices (Cambell & Fiske, 1959). The author sets the stage: "Three [subscores] ...'Analysis,'

'Evaluation,' and 'Inference,' correlate strongly with each other and with the overall CCTST...same is true of the two CCTST [subscores], 'Deductive Reasoning' and 'Inductive Reasoning,' which divide CCTST items along the more traditional matrix." Treating pre and post as methods and the five subscores as traits, the validity diagonal contained one correlation coefficient in the .30s, two in the .40s, and two in the .50s. The hetero trait-monomethod triangles contained two correlations in the .20s, three in the .30s, and three in the .40s. Three estimates of reliability were provided for the total score: KR20s for pretest (.69) and post-test (.68), and a pre-post correlation (.70). Subscore reliability might be estimated using Spearman-Brown; starting from .70 for the total score, reliability for a half-length test would be approximately .54. Given the estimate of reliability, the validity coefficients among subscores appear to this reviewer as reasonably supportive.

RELIABILITY. To summarize the information given above, total-score internal consistency appears to be close to .70. Subscore reliability, although not provided, might be in the .50s. No standard errors of measurement are provided; for the total score the standard error is about 2.5 based on either the typical formula or Lord's approximation.

The reliability information does not support interpretation of differences for individuals, either for a profile or for gain. Subscore reliability is too low and intercorrelations too high to allow a profile to be dependable. Assessment of gain appears impossible: With total KR20s of .69 and .69, and pre-post correlation of .70, the reliability of the difference is estimated to be 0.

NORMS. As noted above, the norm group is composed of undergraduates from one of the California State colleges...The groups contain both native and nonnative English speakers; subgroup norms could easily have been provided. Percentiles are provided for both total score and the five subscores (Conoley & Impara, 1994, p. 37 - 39).

William B. Michael, Professor of Education and Psychology, University of Southern California, Los Angeles, California, adds the following:

The CCTST would appear to possess substantial content validity - perhaps more than any other competing instrument in light of the collective wisdom of the eminent scholars who contributed to its development. The resulting score distributions, which are normal in form, provide a basis for differentiating quite adequately among the examinees. The 34 items are not easy. On the pretest the highest score for the sample of students studied was 29, and on the post-test 31 with a respective means of 15.89 ad 17.27. There may be some concern relative to the 45-minute time limit (Conoley & Impara, 1994, p. 39 - 40).

Appendix B

Agreement to Participate as a Research Subject

Agreement to Participate as a Research Subject

Project Title: The Degree of Change in Critical Thinking Skills in Associate Degree Nursing Students

This research examines the ability to use critical thinking skills. The practice of professional nursing requires the use of critical thinking skills. Critical thinking is a major aim of nursing education. The Madison Area Technical College Associate Degree Nursing Advisory committee has identified critical thinking as an essential skill for nursing graduates. This study will measure critical thinking ability over the two years of study in the Associate Degree Nursing program.

RISKS:

There is little or no risk to you in taking the tests. The California Critical Thinking Skills Test is a standardized test which has been used nationally to measure students' ability to do critical thinking.

BENEFITS:

Although the results of this study may help us to provide better program instruction in the future, there is no direct benefit to you by participating in this study. MATC has always been very proud of the quality of this program. You will help to maintain that quality for future program students.

CONFIDENTIALITY OF RESPONSES:

Your answers are strictly confidential. Only the primary researcher or her designee will have access to the confidential raw data. Neither the answers or results of this study will in any way affect your course grades or your progress through this program of study. Neither your name, identifying number, or you personal answers will ever be published.

RIGHT TO WITHDRAW OR DECLINE TO PARTICIPATE:

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. Should you choose to participate and later wish to withdraw from the study, you may discontinue your participation at that time without incurring adverse consequences.

I attest that I have read and understand the above descriptions, including potential risks, benefits, and my rights as a participant, and that all my questions about the study have been answered to my satisfaction. I hereby give my informed consent to participate in this research study.

Signature _____ Date _____